

Dioxin Fingerprinting in the HSC

Linda Broach, TCEQ

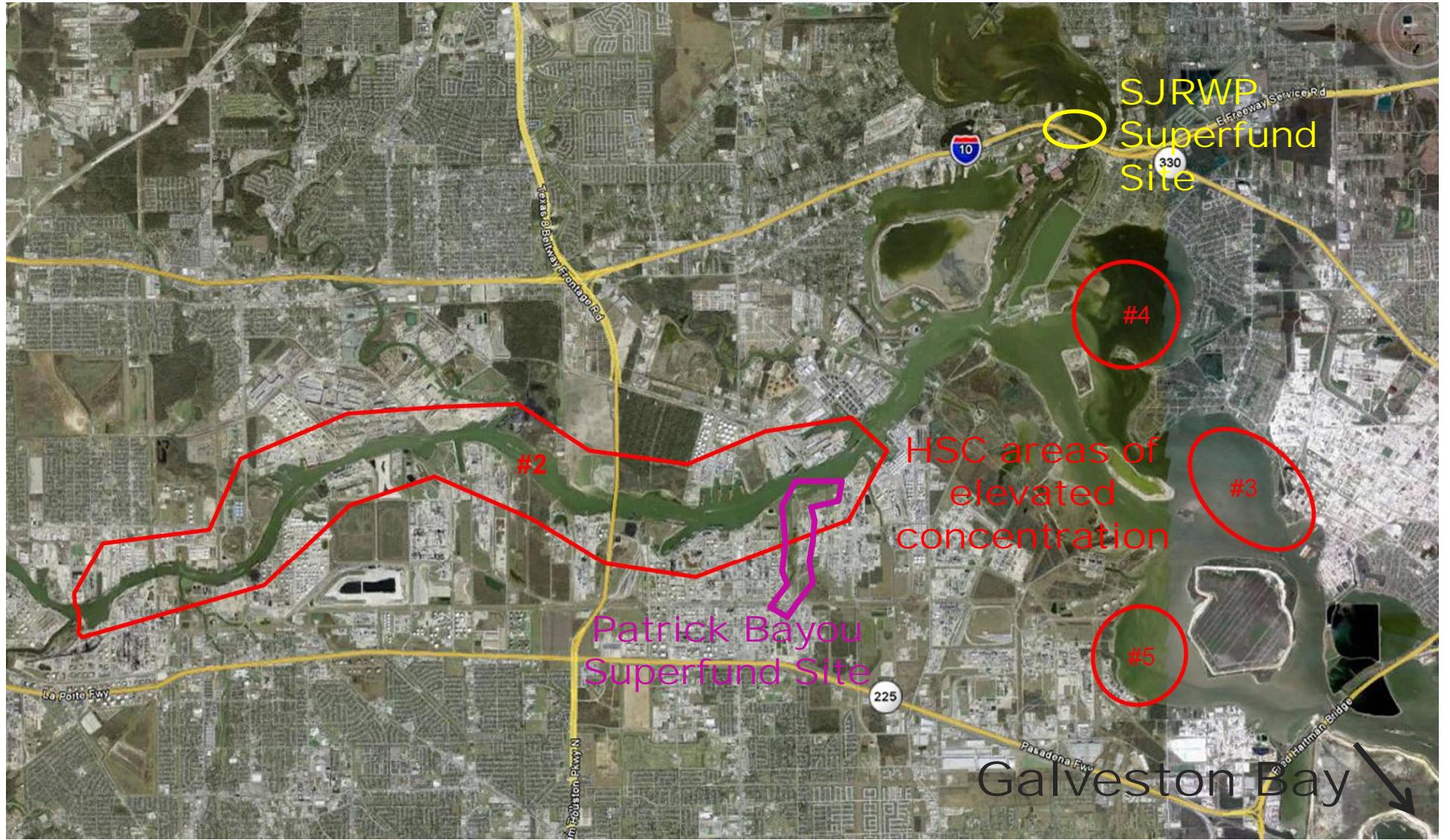
Philip Turner, EPA R6

Jan 2012

Objectives

- Compare dioxin fingerprints from several areas of the HSC to the SJRWP superfund site:
 - Patrick Bayou superfund site
 - HSC from Sims Bayou to Tucker Bayou
 - Burnett Bay
 - Scott Bay
 - San Jacinto Bay
 - Galveston Bay along the HSC

Areas of Interest for this project:



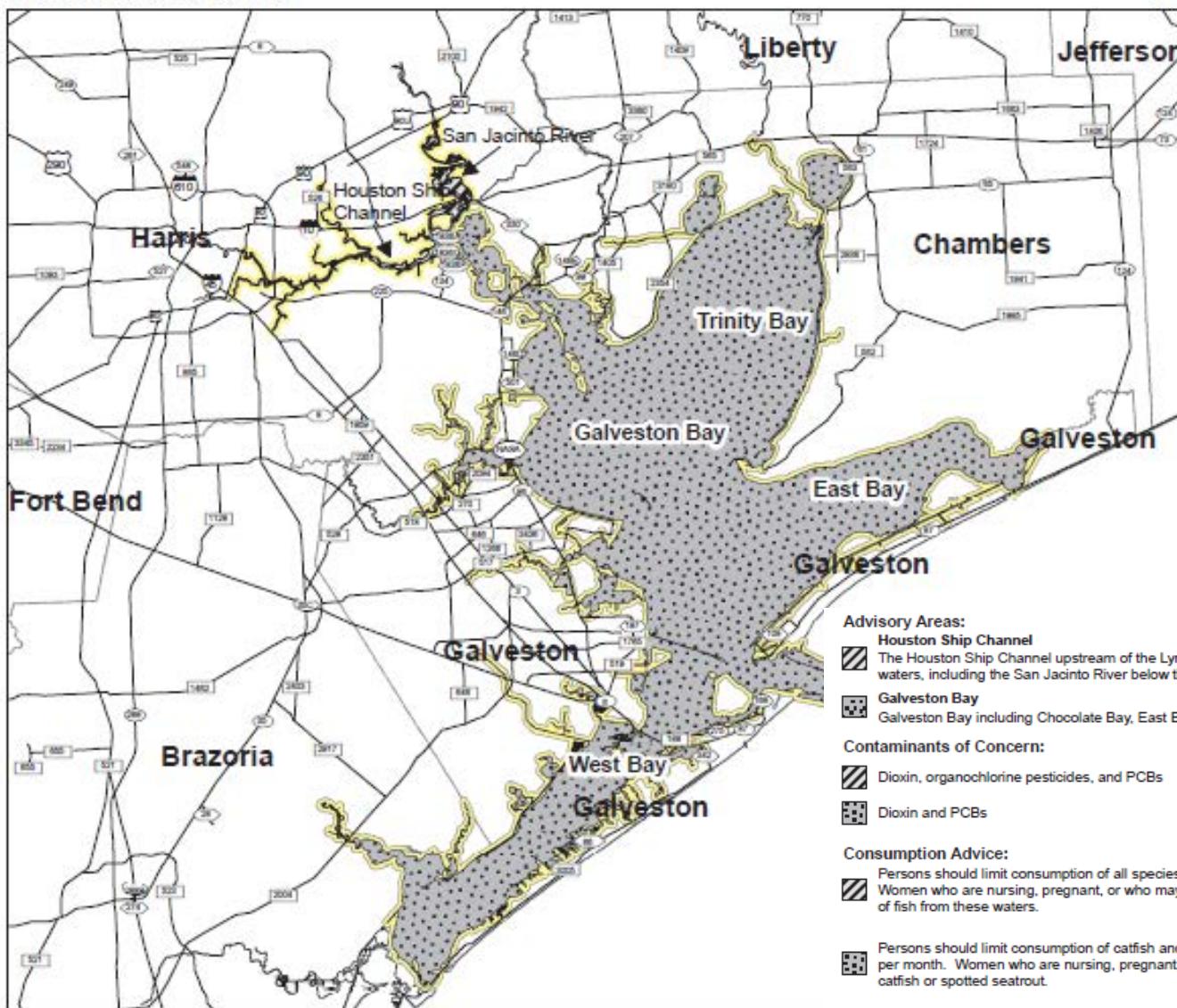
Fish Tissue Advisories for Dioxin

Houston Ship Channel and Galveston Bay

Brazoria, Chambers, Galveston, and Harris Counties

ADV-20 Issued October 9, 2001

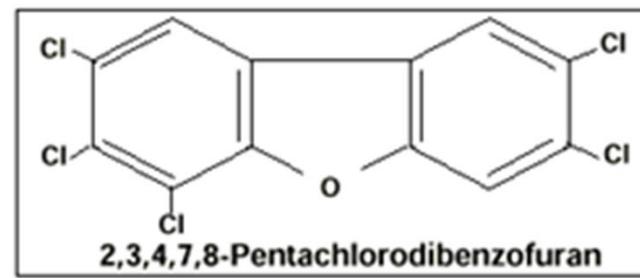
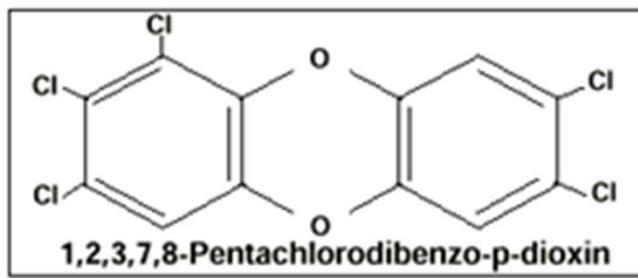
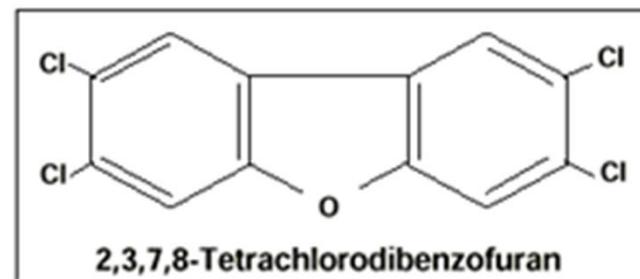
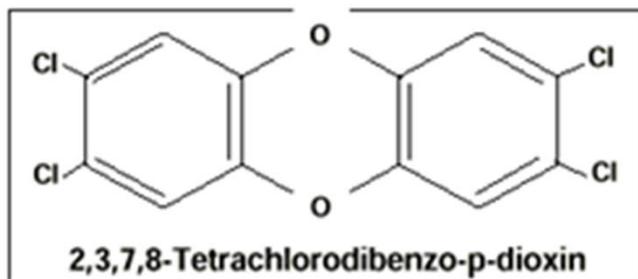
ADV-35 Issued July 8, 2008



Methods

- Used Surface Sediment data from SJRWP site geodatabase, Patrick Bayou site database, and EPA Marine and Coastal Studies report
- Used 2 upstream stations in the SJR as background – 11200 and 16622
- Plotted highest 12 samples from inside SJRWP to describe pit “fingerprint”
- All values given are station averages, if more than one sample was available for a site
- TEQs computed using WHO TEFs with ND=0
- Fingerprint is computed by dividing each congener by the total for all 2,3,7,8 dioxin and furan congeners except OCDD, which was omitted for clarity

Dioxins and Furans . . .

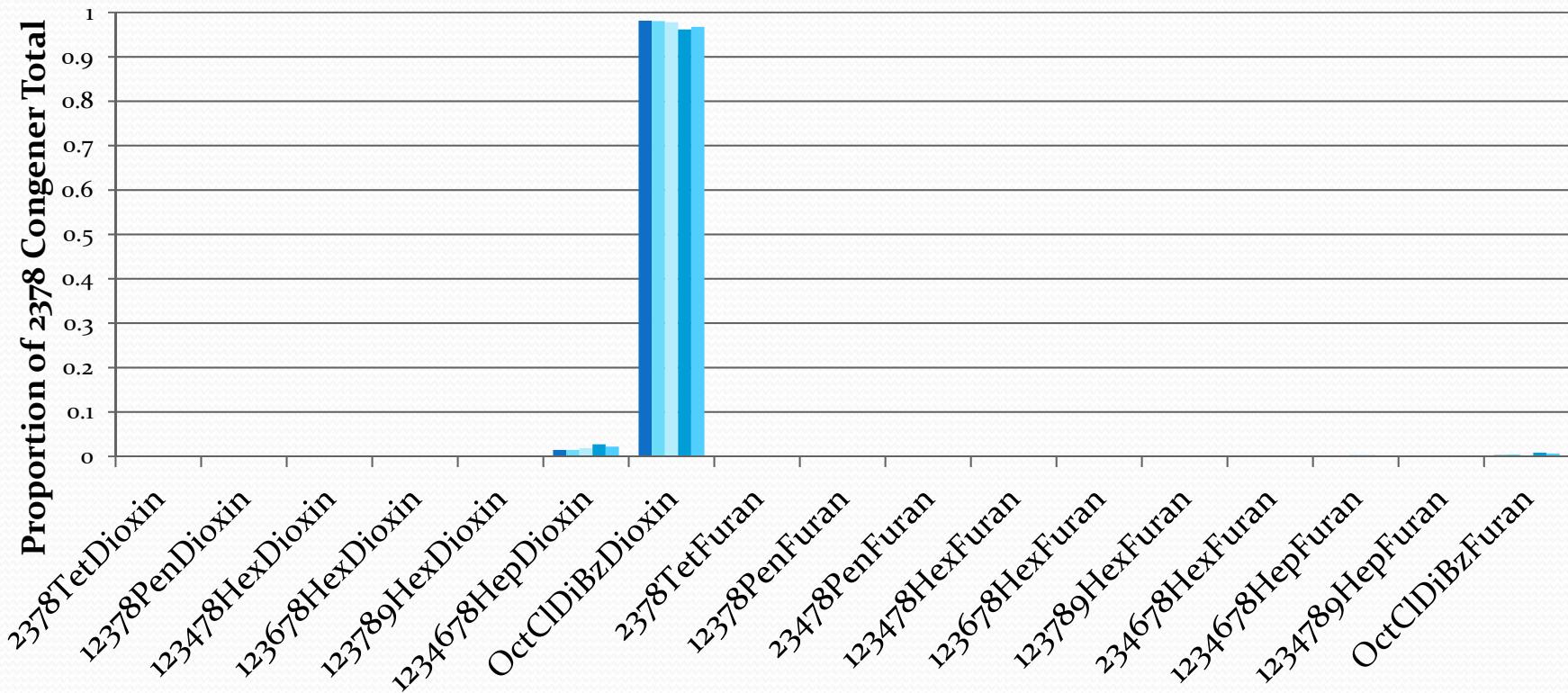


TOXIC EQUIVALENCY FACTORS (TEFs)

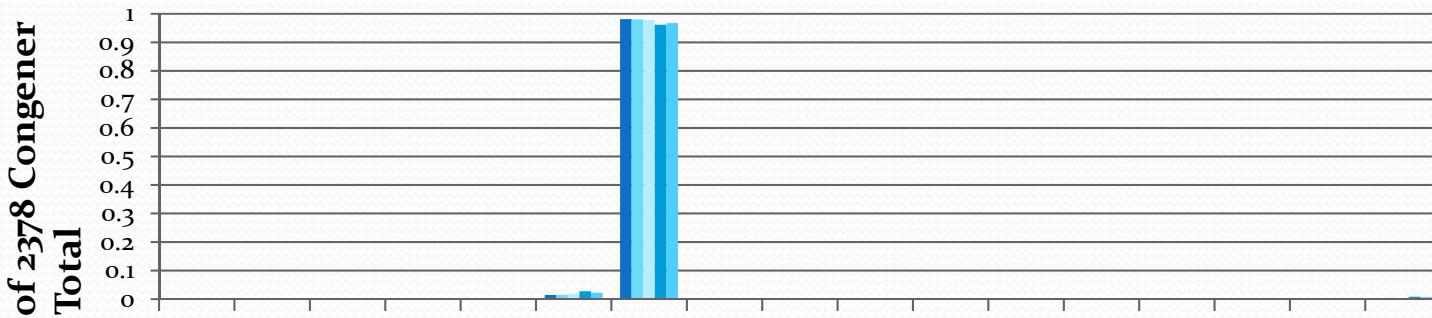
	TEF
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.1
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.01
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	0.0003
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.1
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.03
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.3
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.1
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.1
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.01
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	0.0003

CONGENER FINGERPRINT

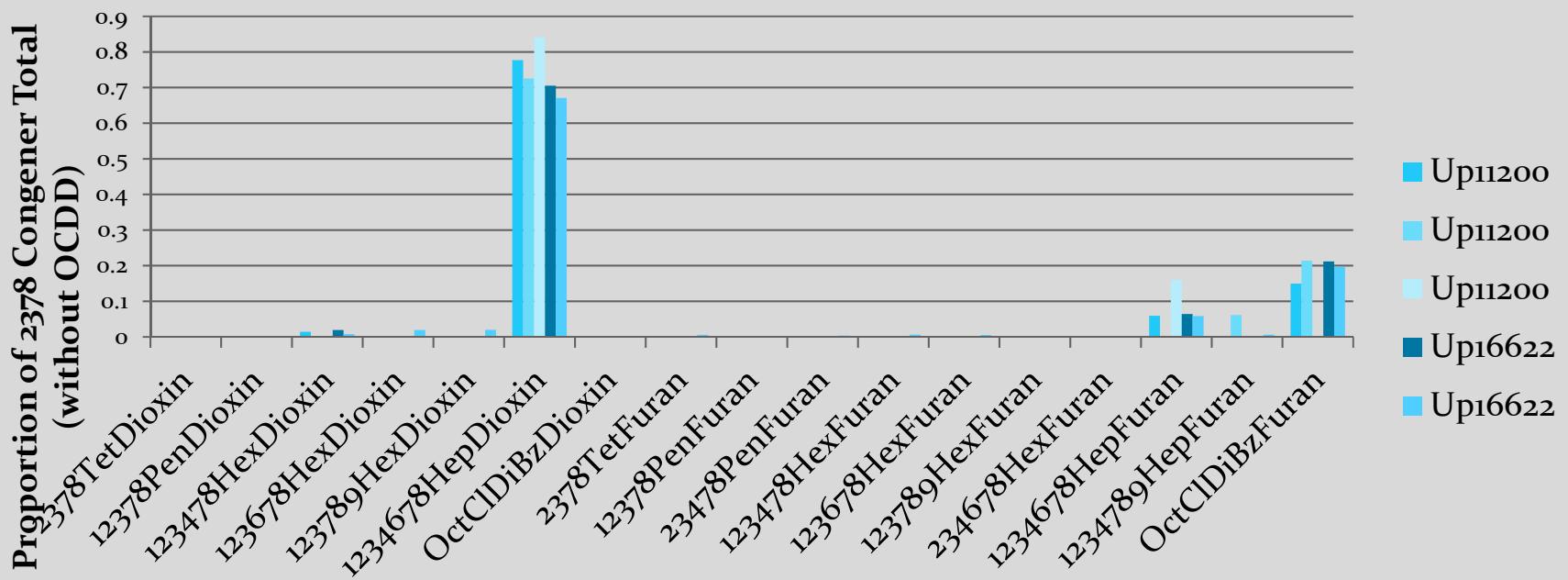
Upstream SJR samples with OCDD



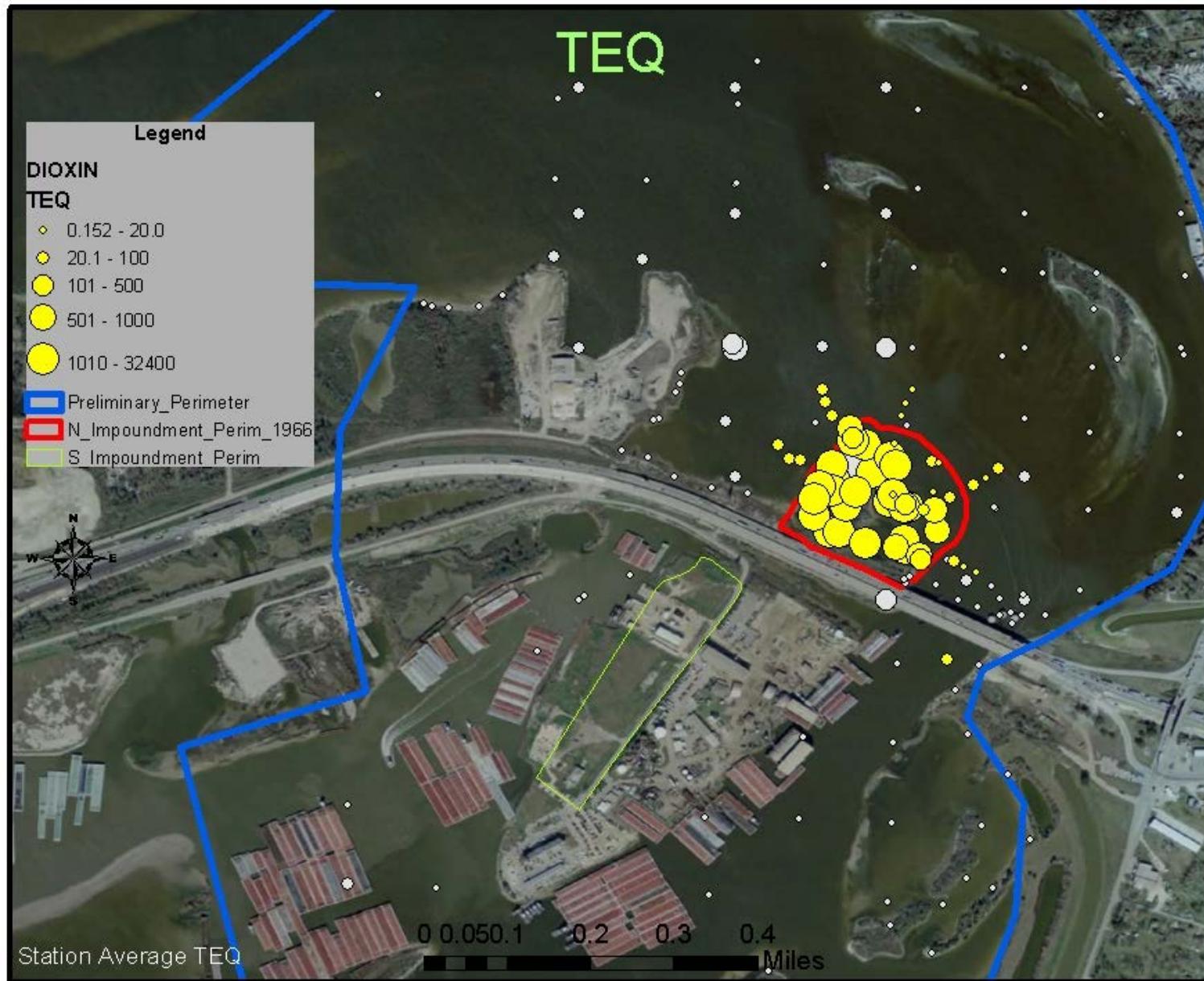
Upstream SJR samples with OCDD



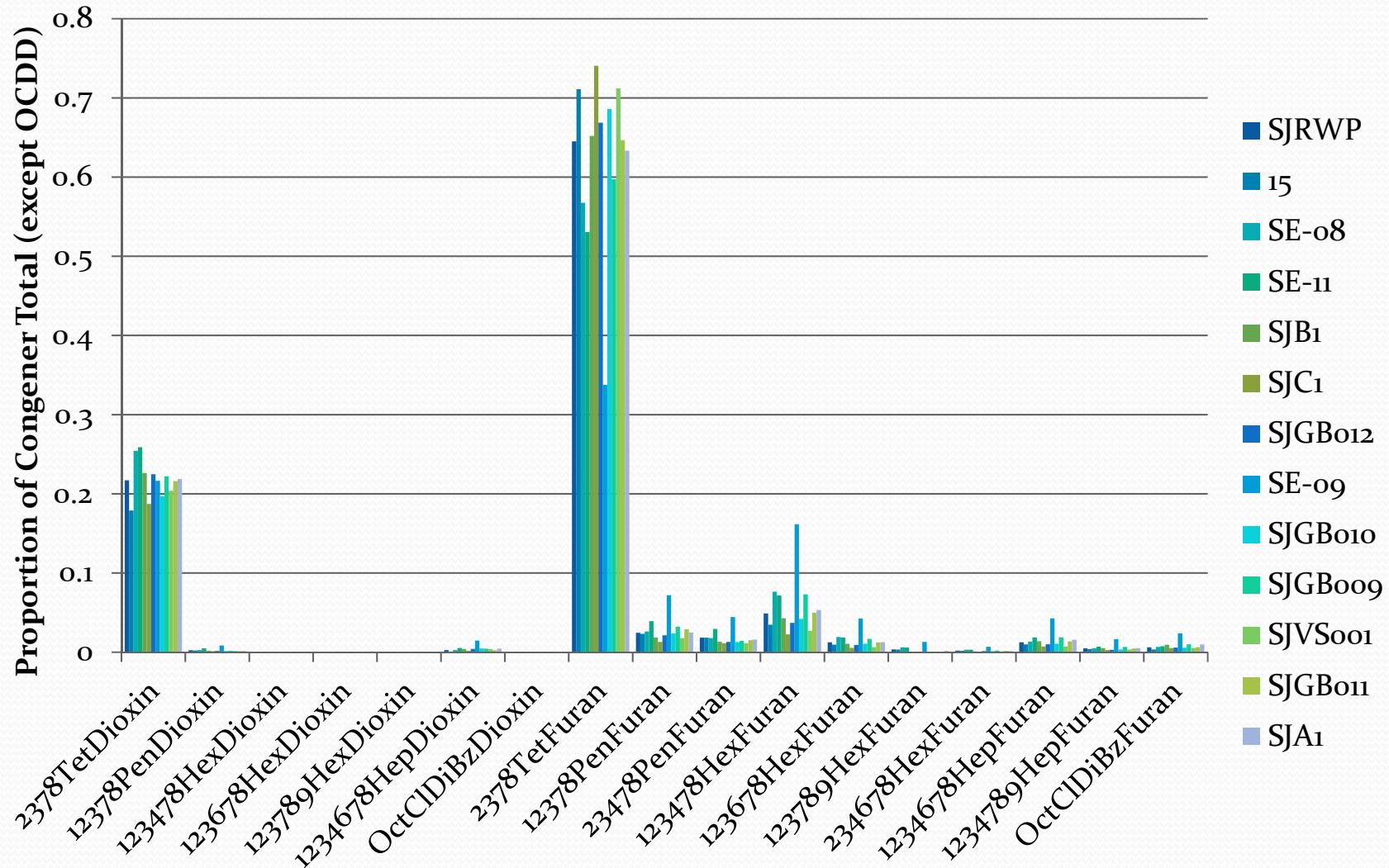
Upstream SJR samples without OCDD



TEQ in SJRWP area



SJRWP Congener Fingerprint

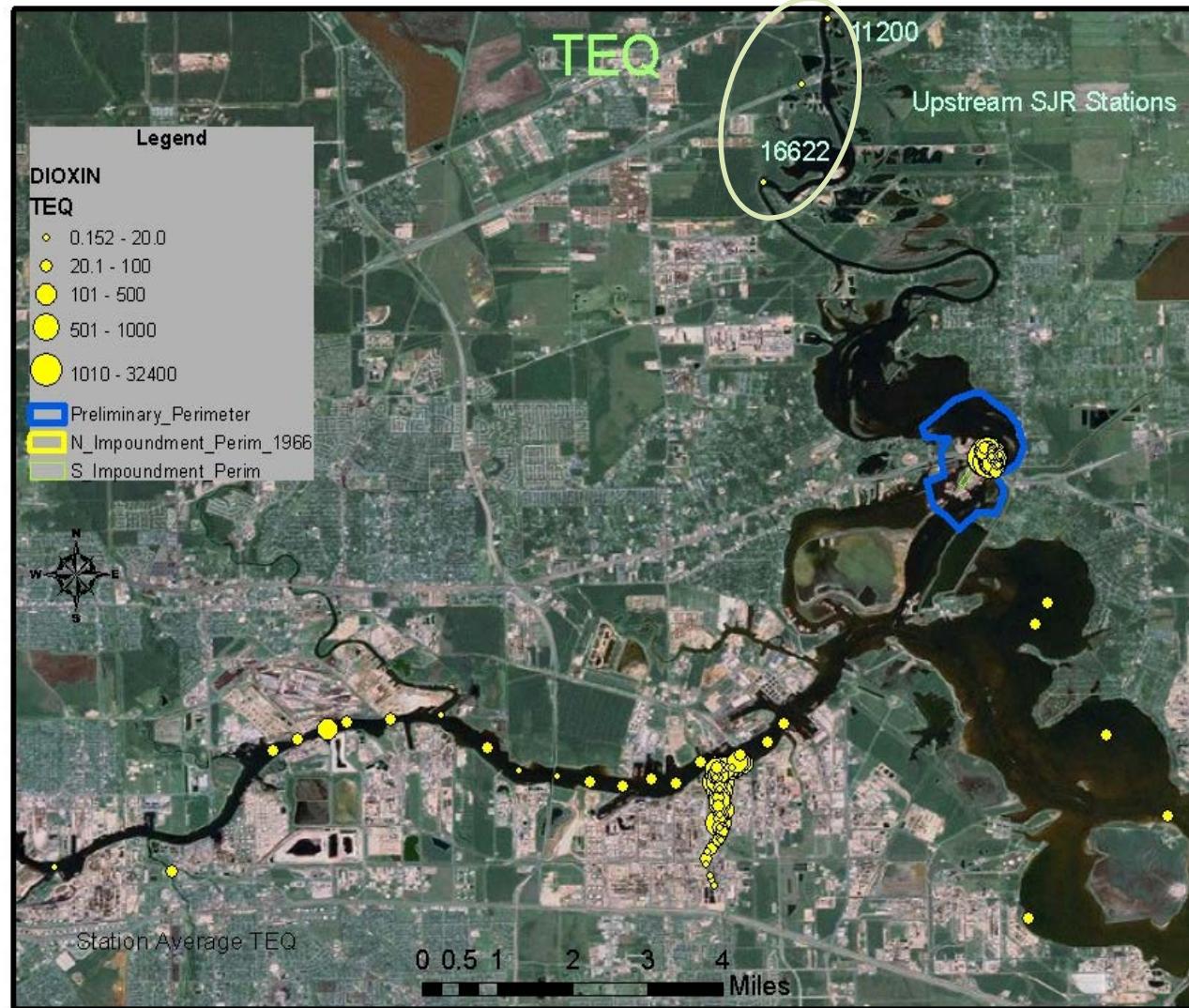


TEQ range = 10,080 to 32,400 ppt

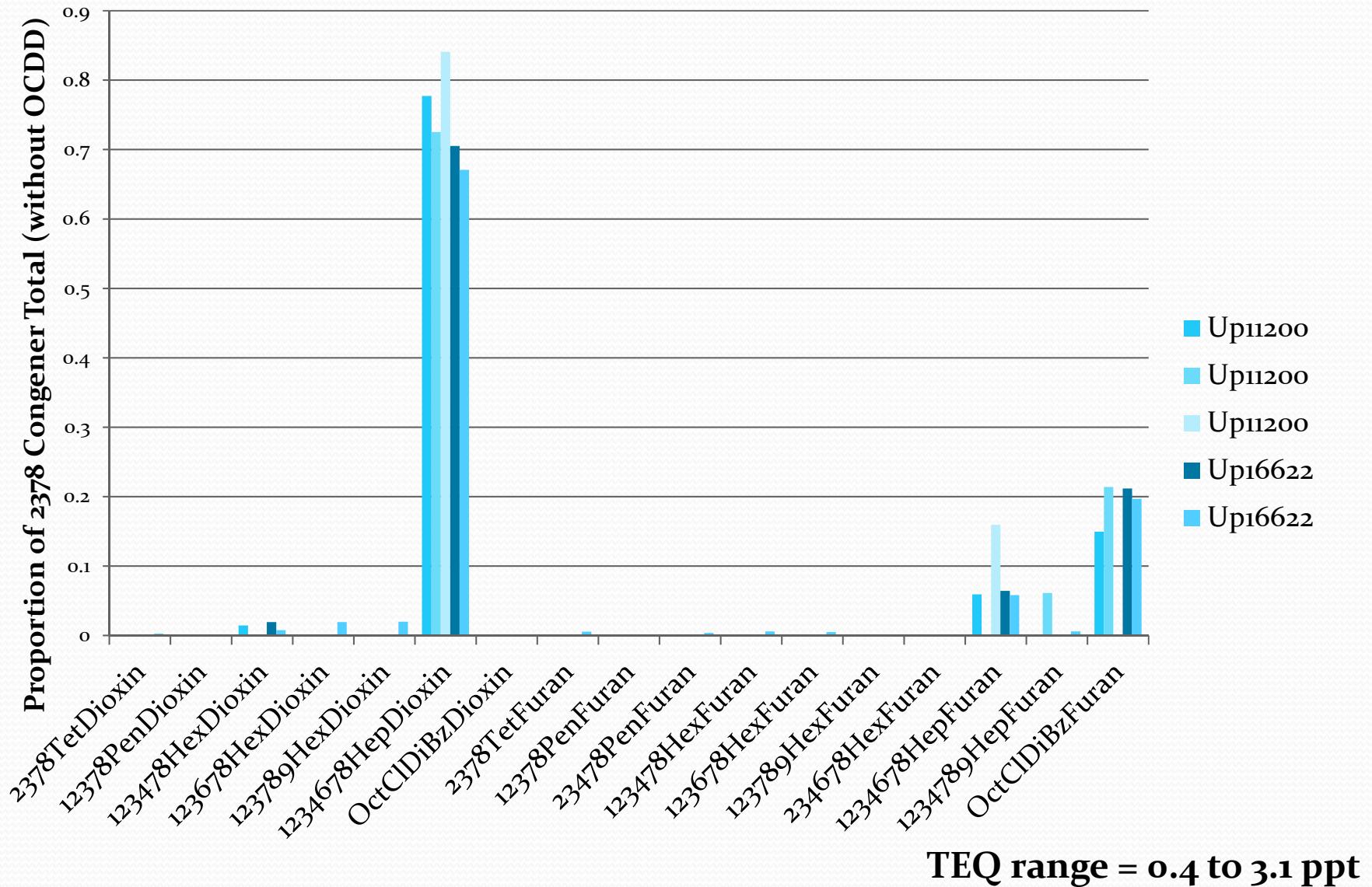
Observations - SJRWP

- SJRW Pits are not homogenous
- Clear evidence of deposition from other sources and “clean” mud
- Congener fingerprint is dominated by
 - **2378 Tetra-furan (TCDF),**
 - **2378 Tetra-dioxin (TCDD),**
 - and smaller amounts of other furans

Upstream Station Locations



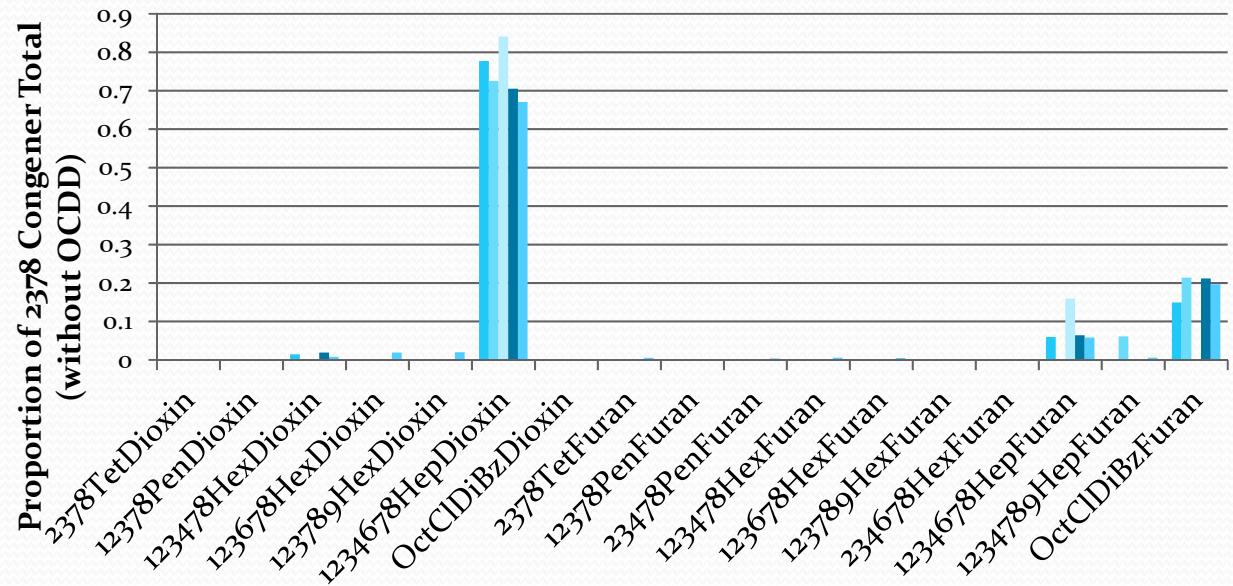
Upstream SJR samples



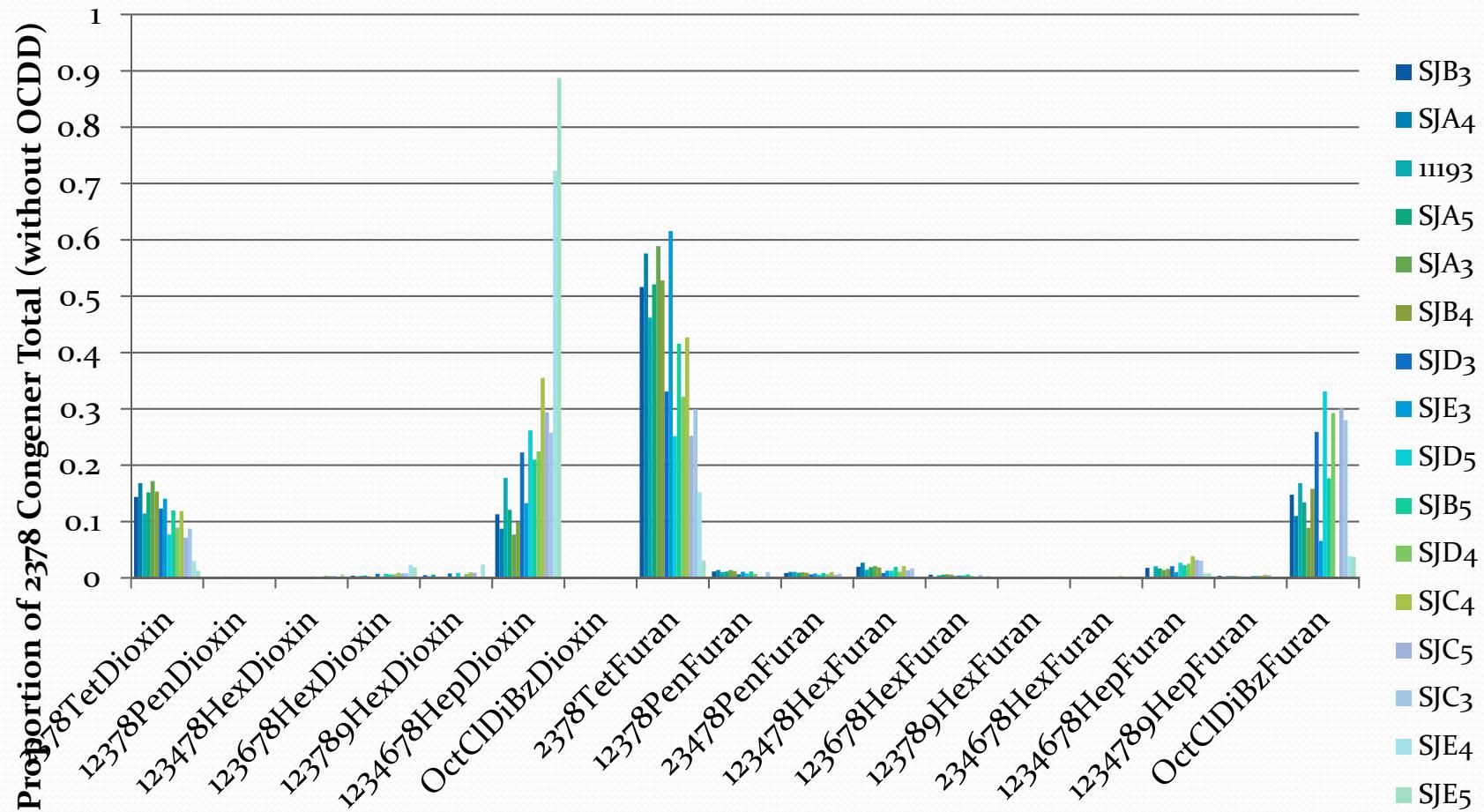
Upstream SJR

- Upstream (background) fingerprint dominated by
 - 1234678 HpCDD,
 - OCDF,
 - 1234678 HpCDF,
 - 1234789 HpCDF

Upstream SJR samples



Congener Fingerprint for Samples near the SJRWP

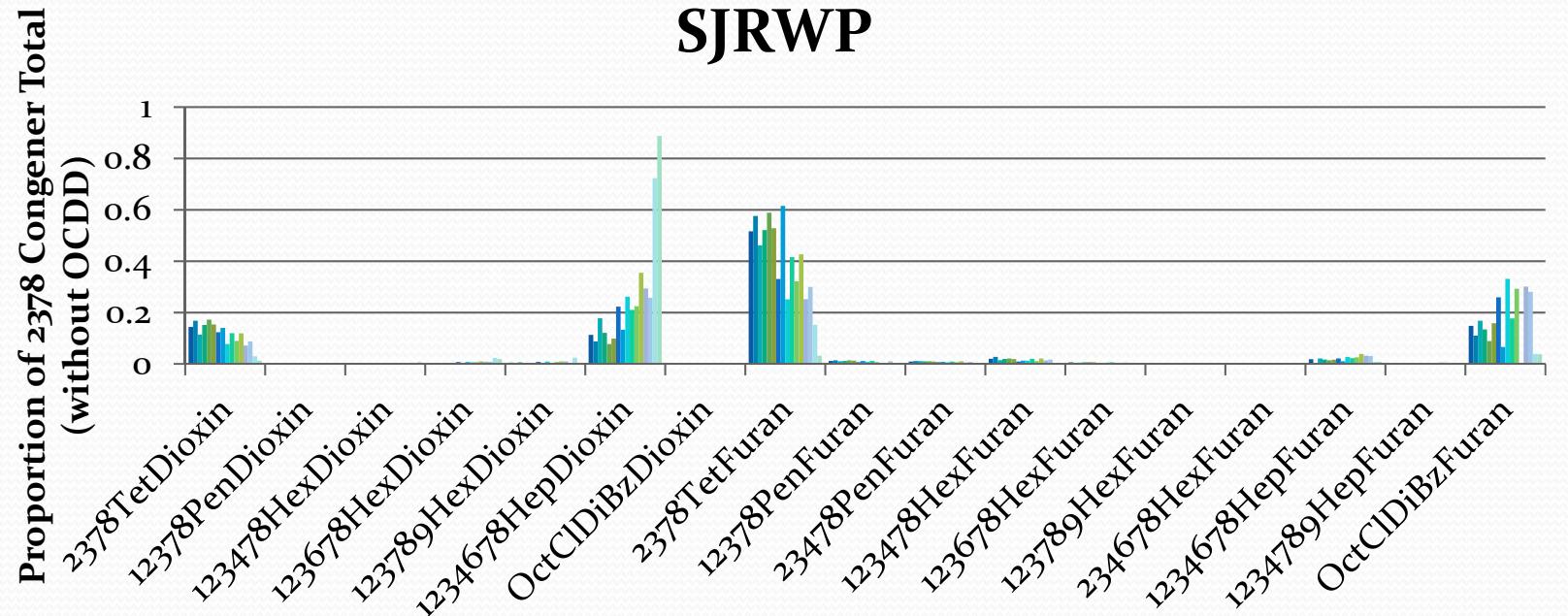


TEQ range for these samples = **93 to 2.4 ppt**
(arranged from highest to lowest in graph)

Near Pit samples

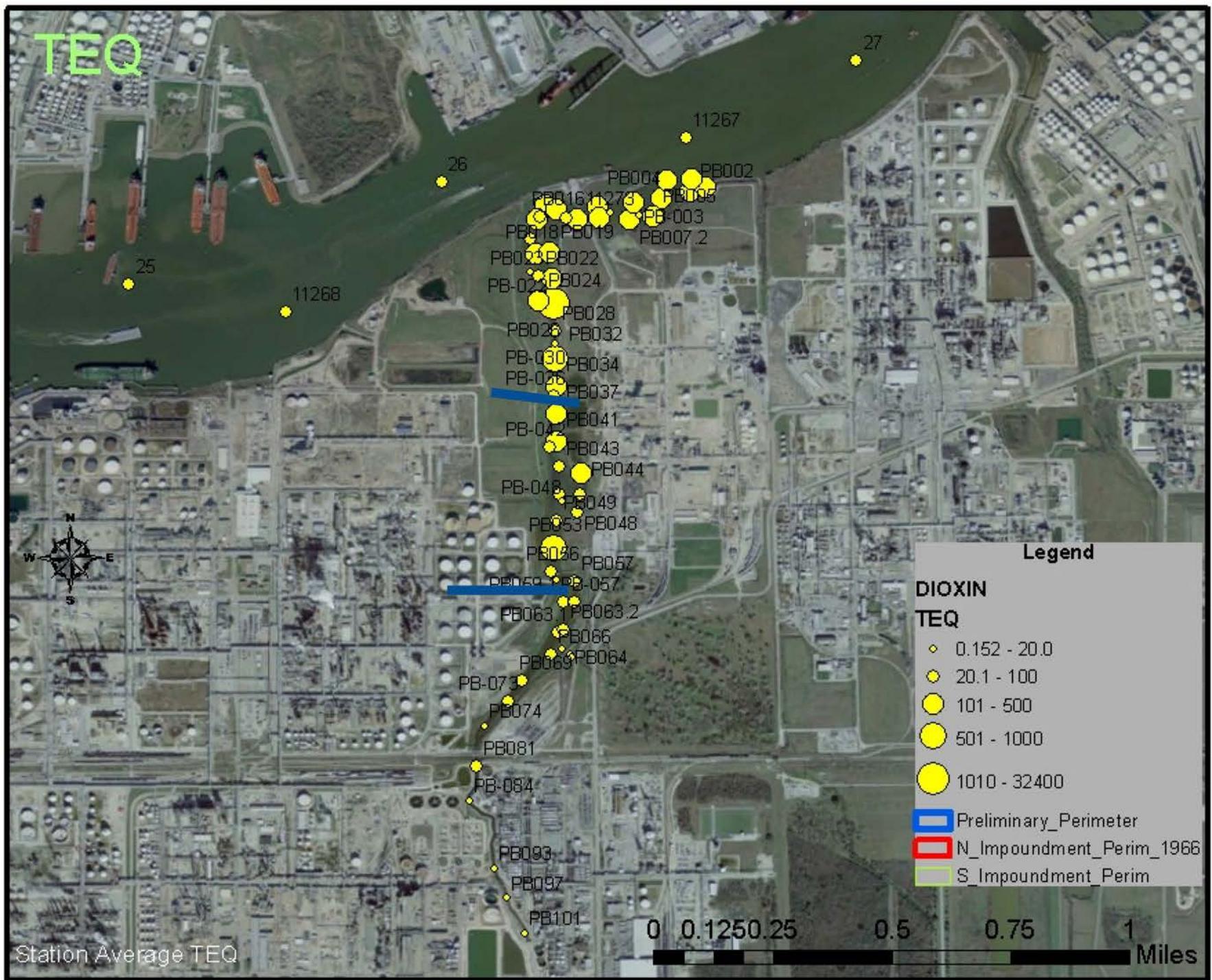
- Near-pit fingerprints are similar to pits,
 - but with lots more HpCDDs and OCDFs
 - and less PeCDFs and HxCDFs
- You can see the decline in %TCDF and %TCDD with the increase in %HpCDD

Congener Fingerprint for Samples near the SJRWP

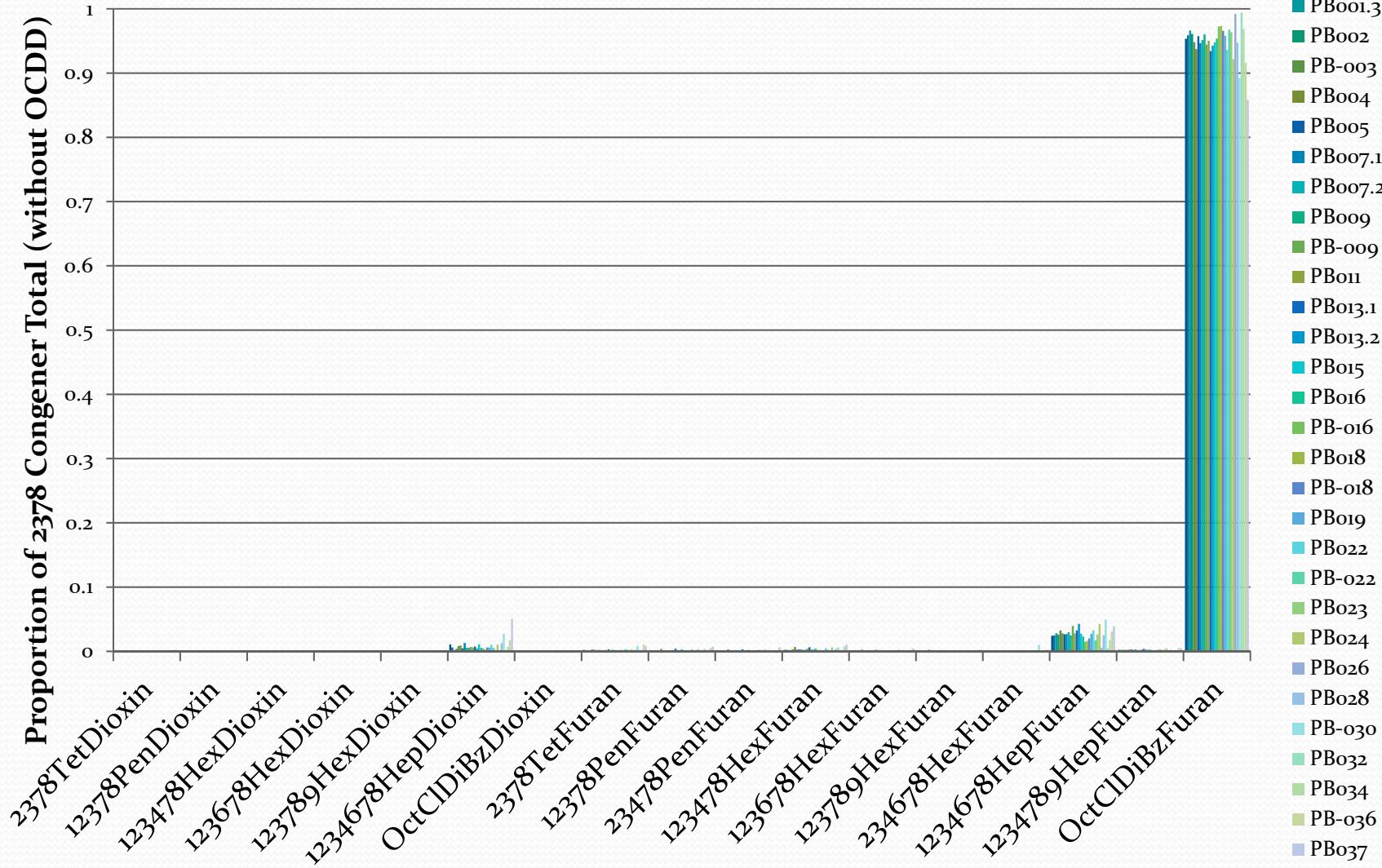


Patrick Bayou

- 60 stations
- TEQ range: 0.2 to 2224 ppt
 - Average TEQ = 133 ppt (Median = 73 ppt)
- High OCDF in lower reach
- Middle and upper reaches have various fingerprints

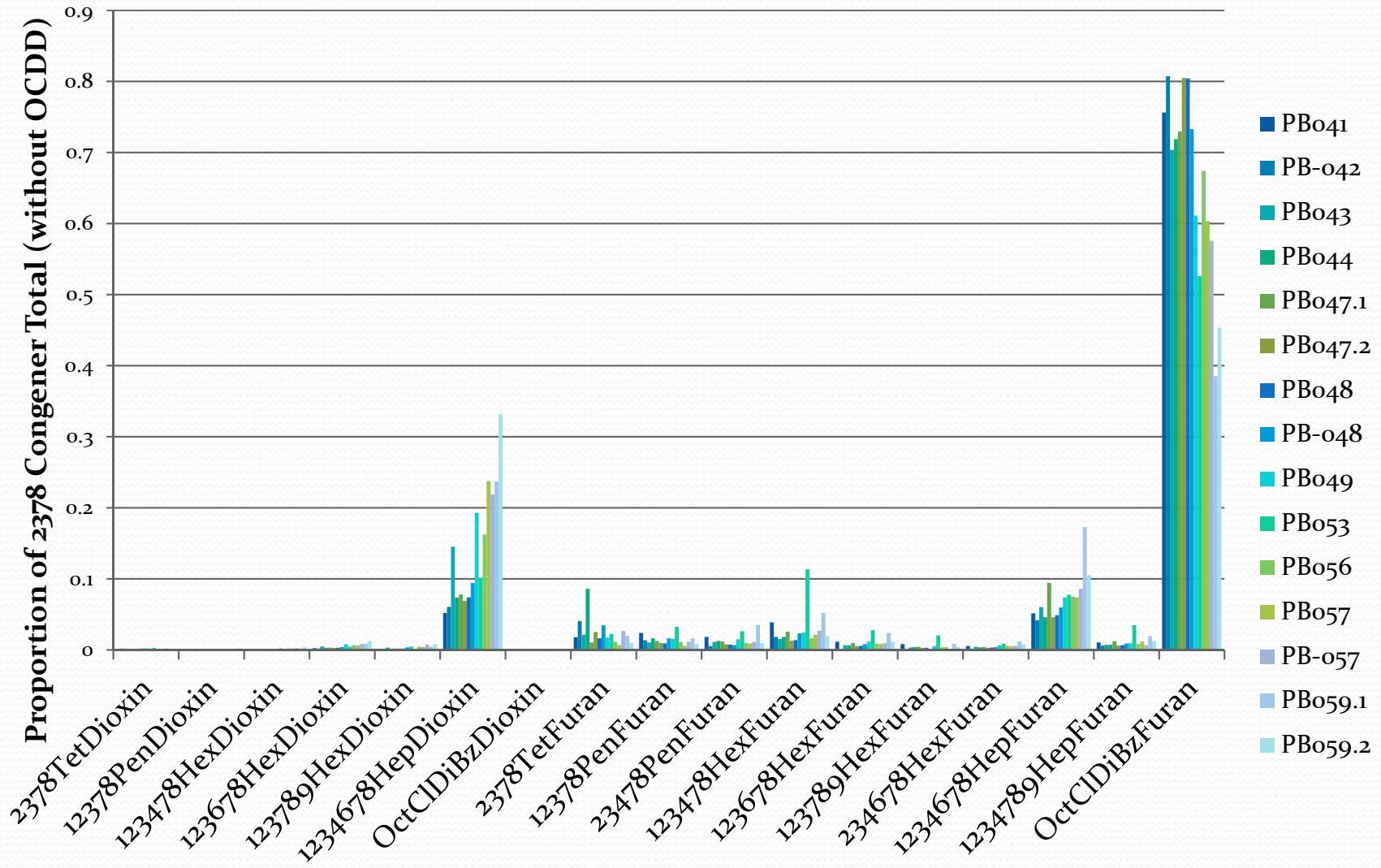


Lower Patrick Bayou



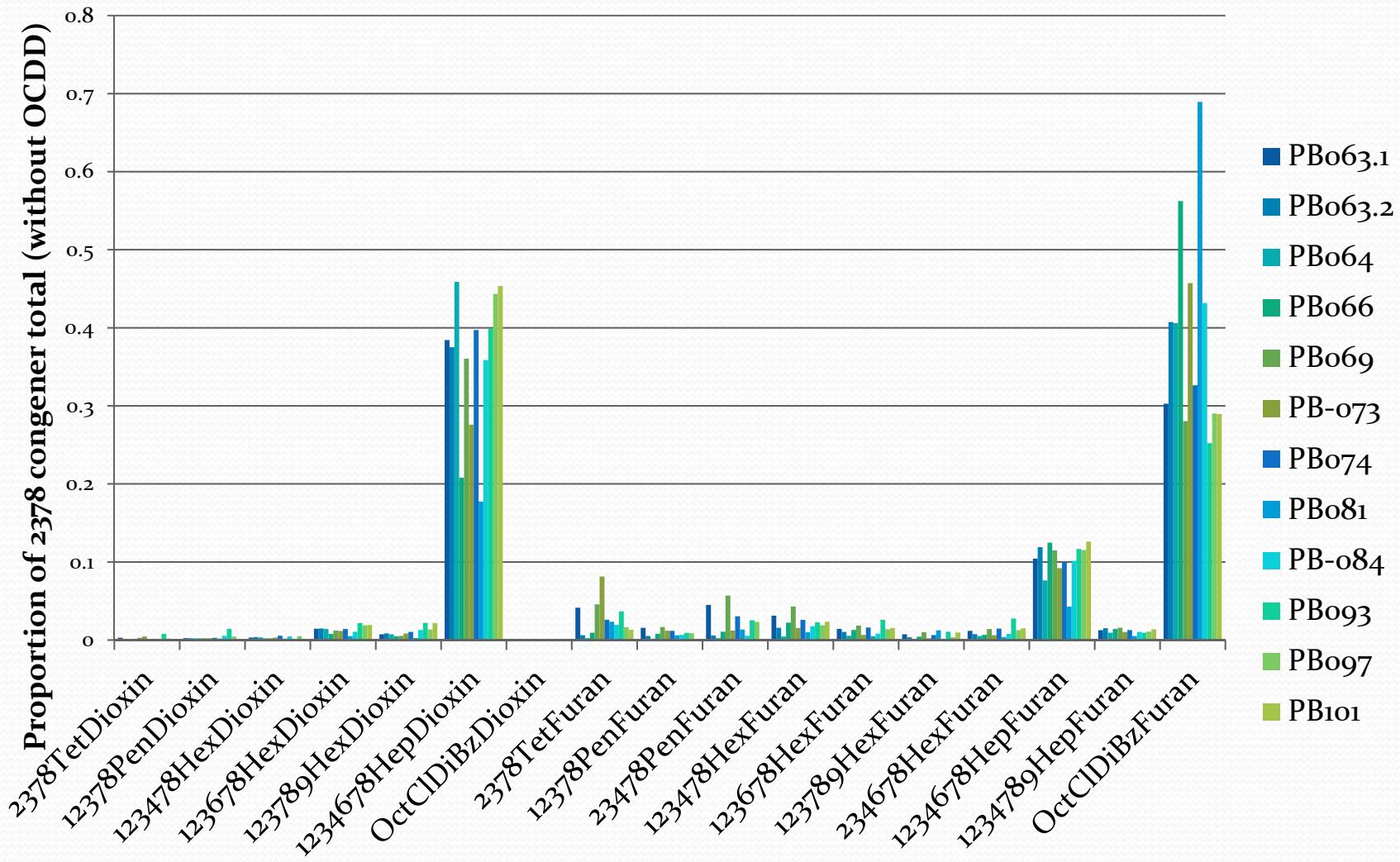
31 sites, average TEQ = 209 ppt, max TEQ = 2224 ppt at PBo26

Middle Patrick Bayou



15 sites, average TEQ = 99 ppt, max TEQ = 610 ppt at PBo5

Upper Patrick Bayou

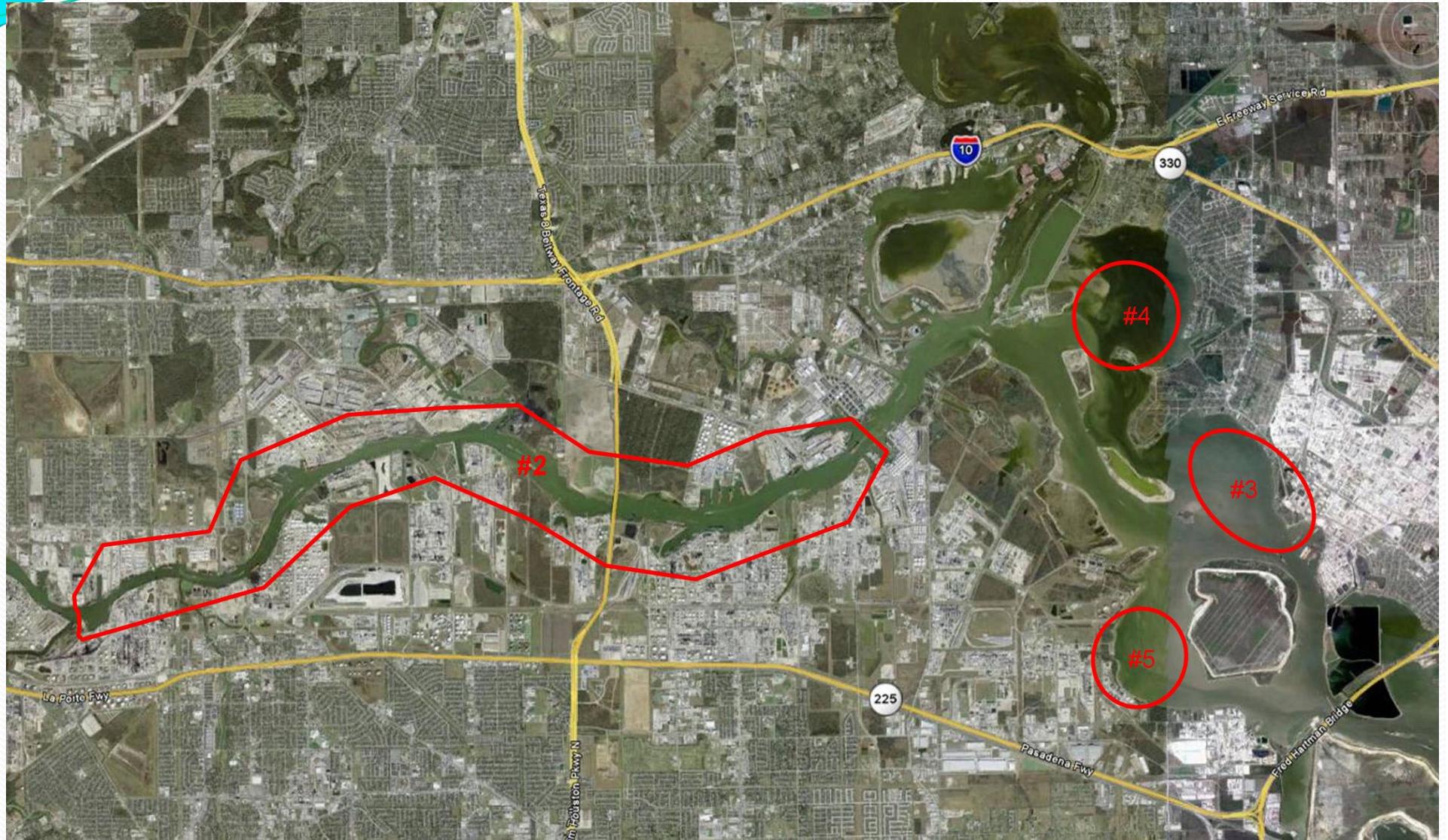


12 sites, average TEQ = 26 ppt, max TEQ = 84 ppt at PBo69

Observations – Patrick Bayou

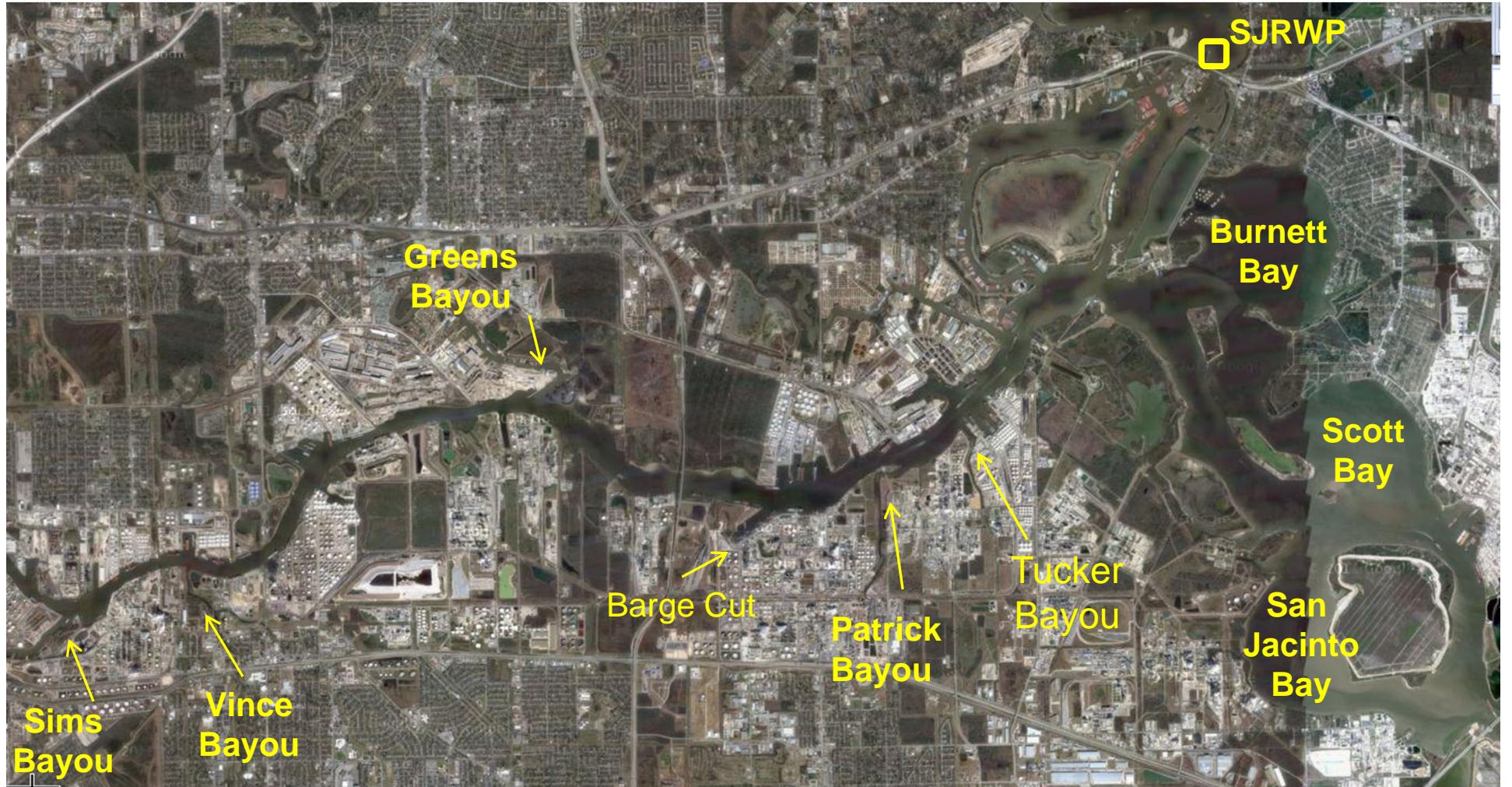
- Patrick Bayou downstream fingerprint dominated by OCDF
- Upstream fingerprint includes HpCDD and one of the HpCDFs, in addition to the OCDF
- Cleaner signal downstream, and as move upstream (away from HSC) more congeners appear
- In HSC, strong decrease in OCDFs away from Patrick Bayou

HSC – areas of noted elevated concentrations

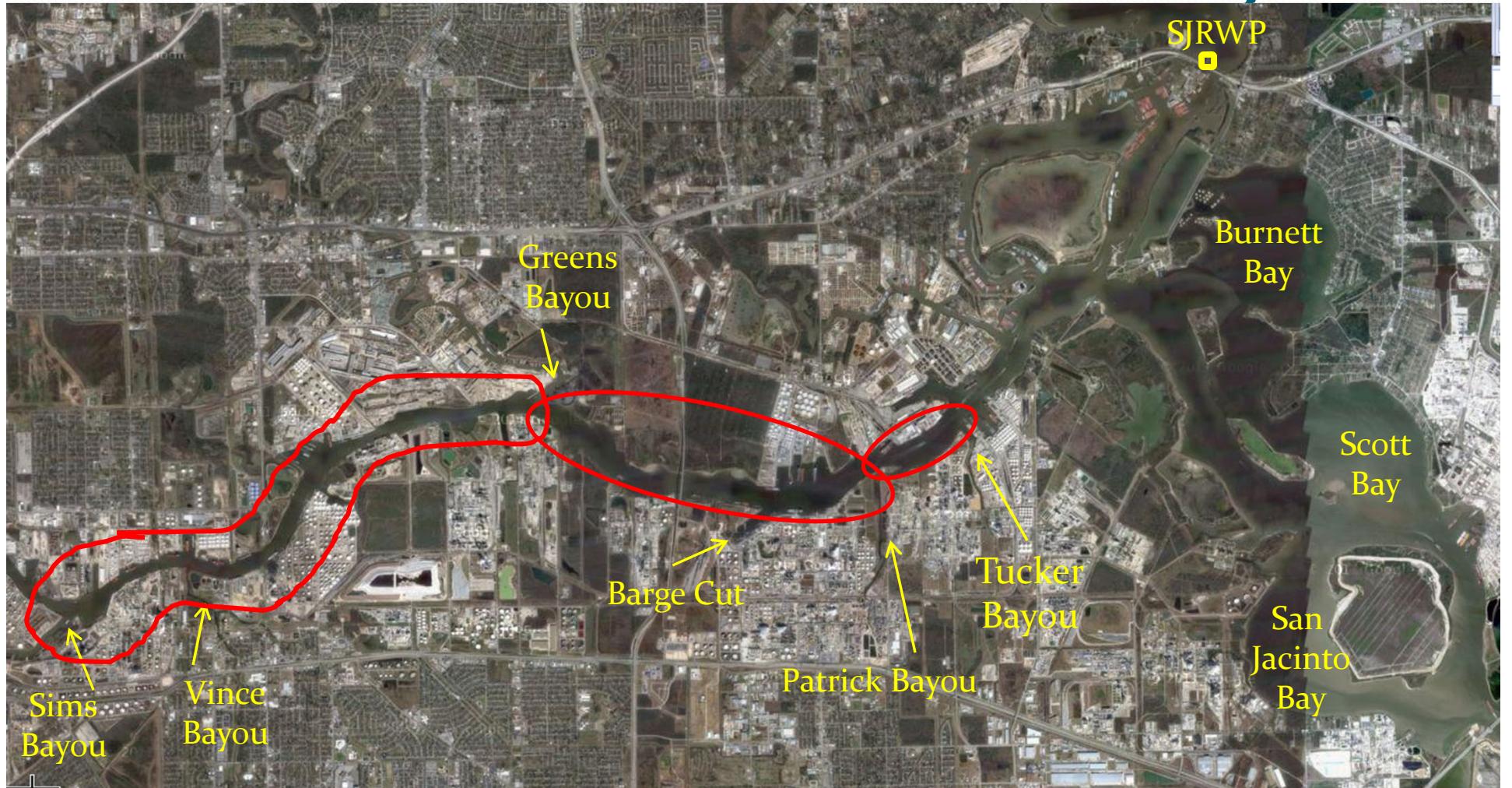


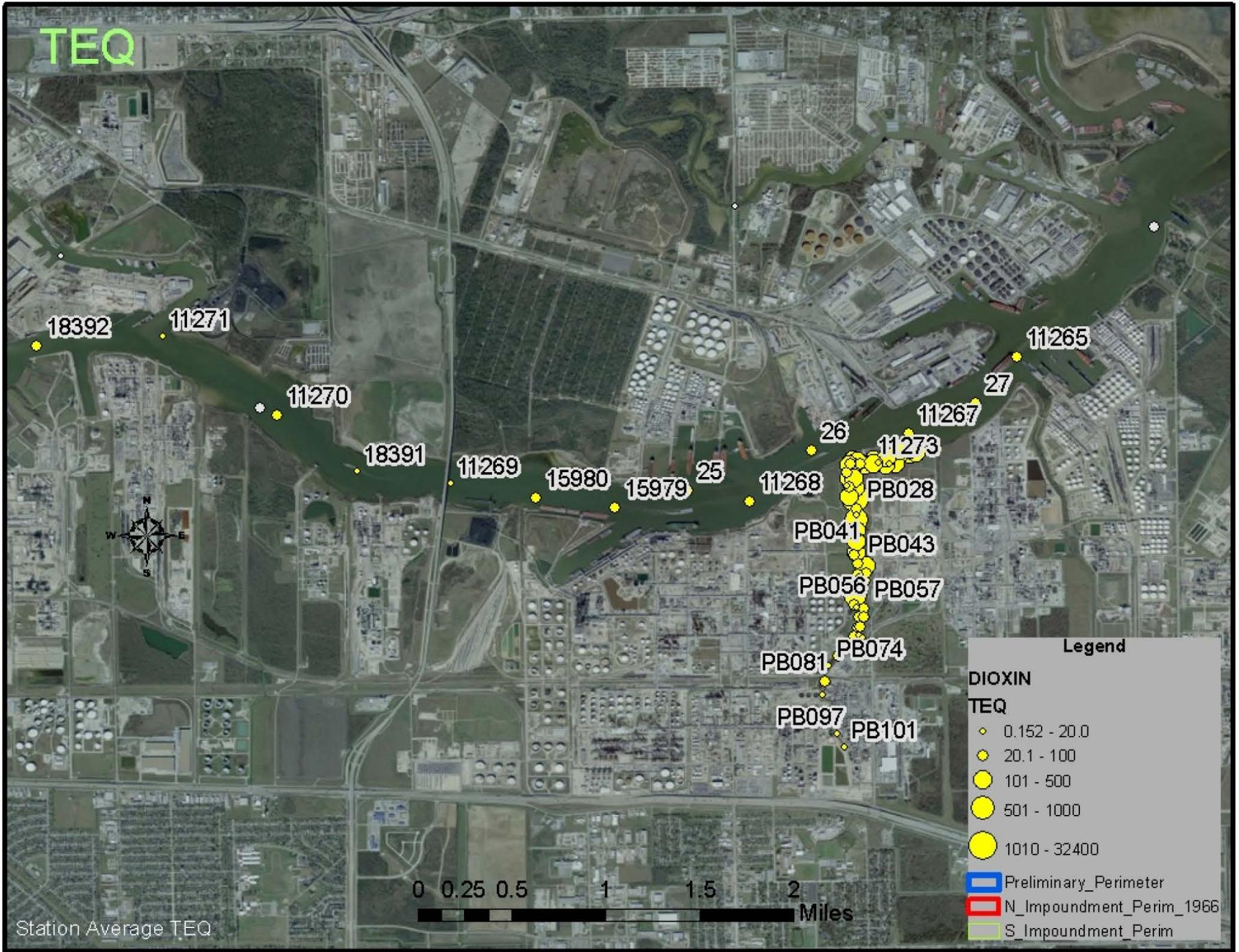
#2 = Buffalo Bayou of HSC; #3 = Scott Bay; #4 = Burnett Bay; #5 = San Jacinto Bay

HSC Tributaries and Side Bays

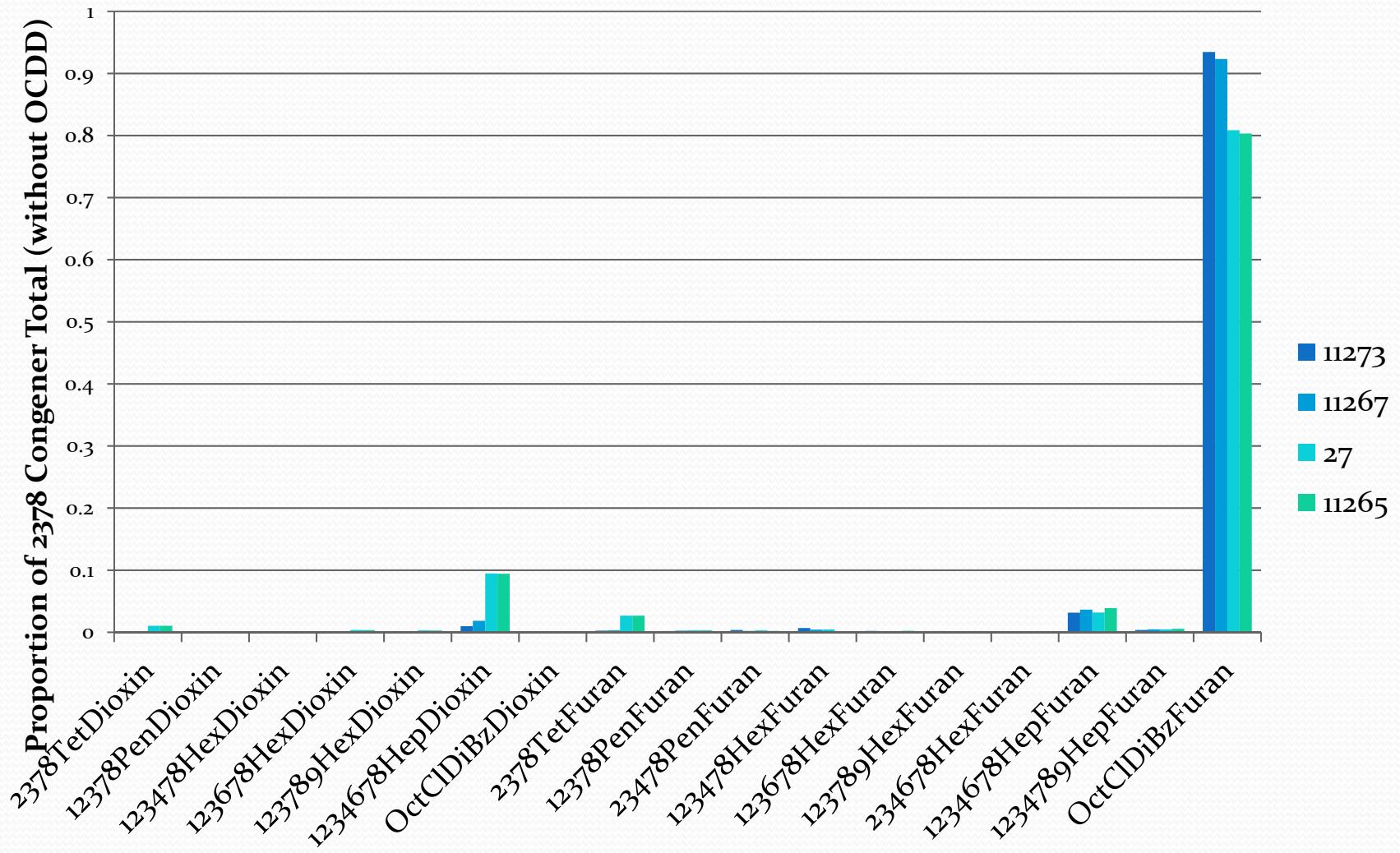


HSC Tributaries and Side Bays



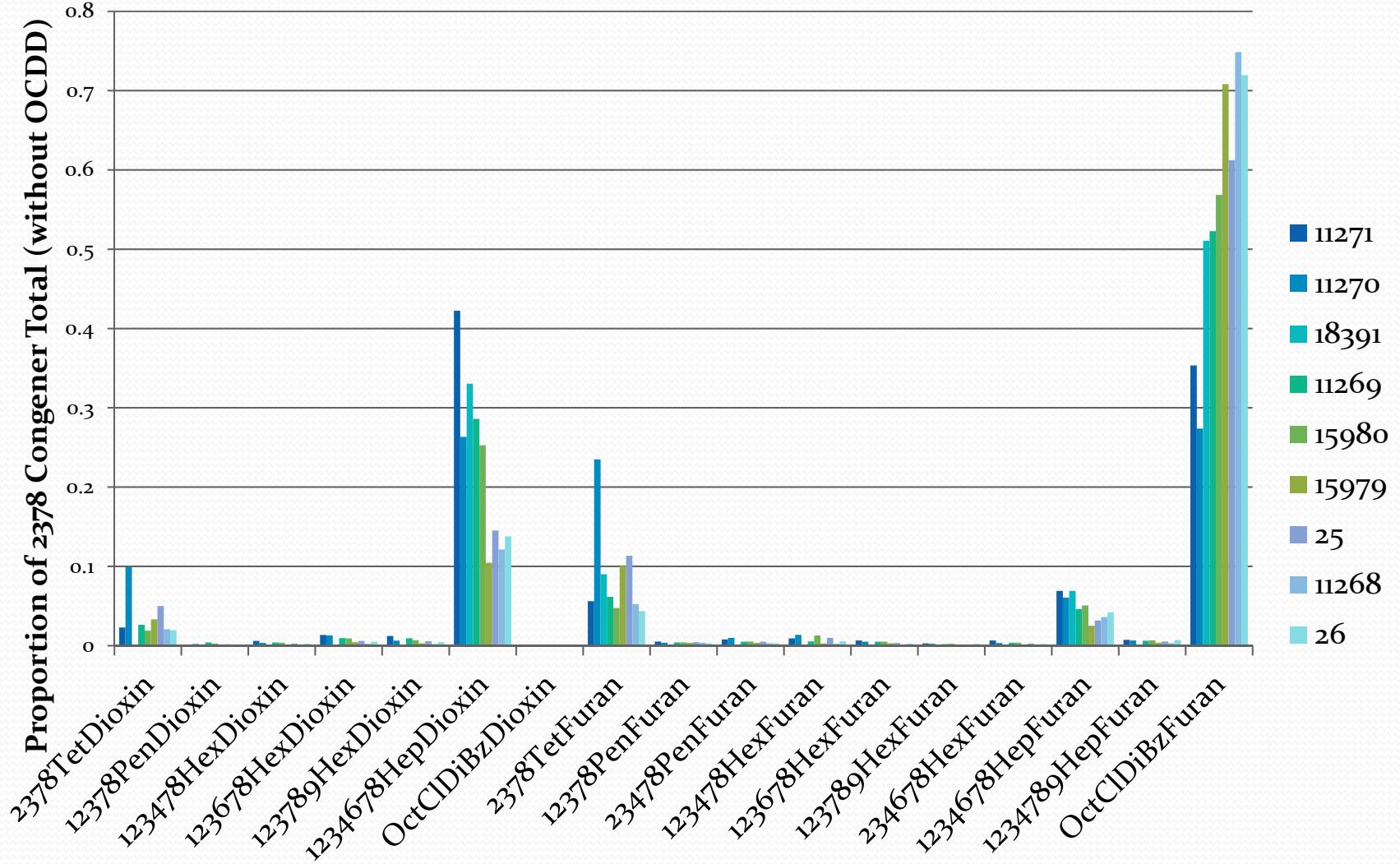


HSC - Patrick Bayou to Tucker Bayou



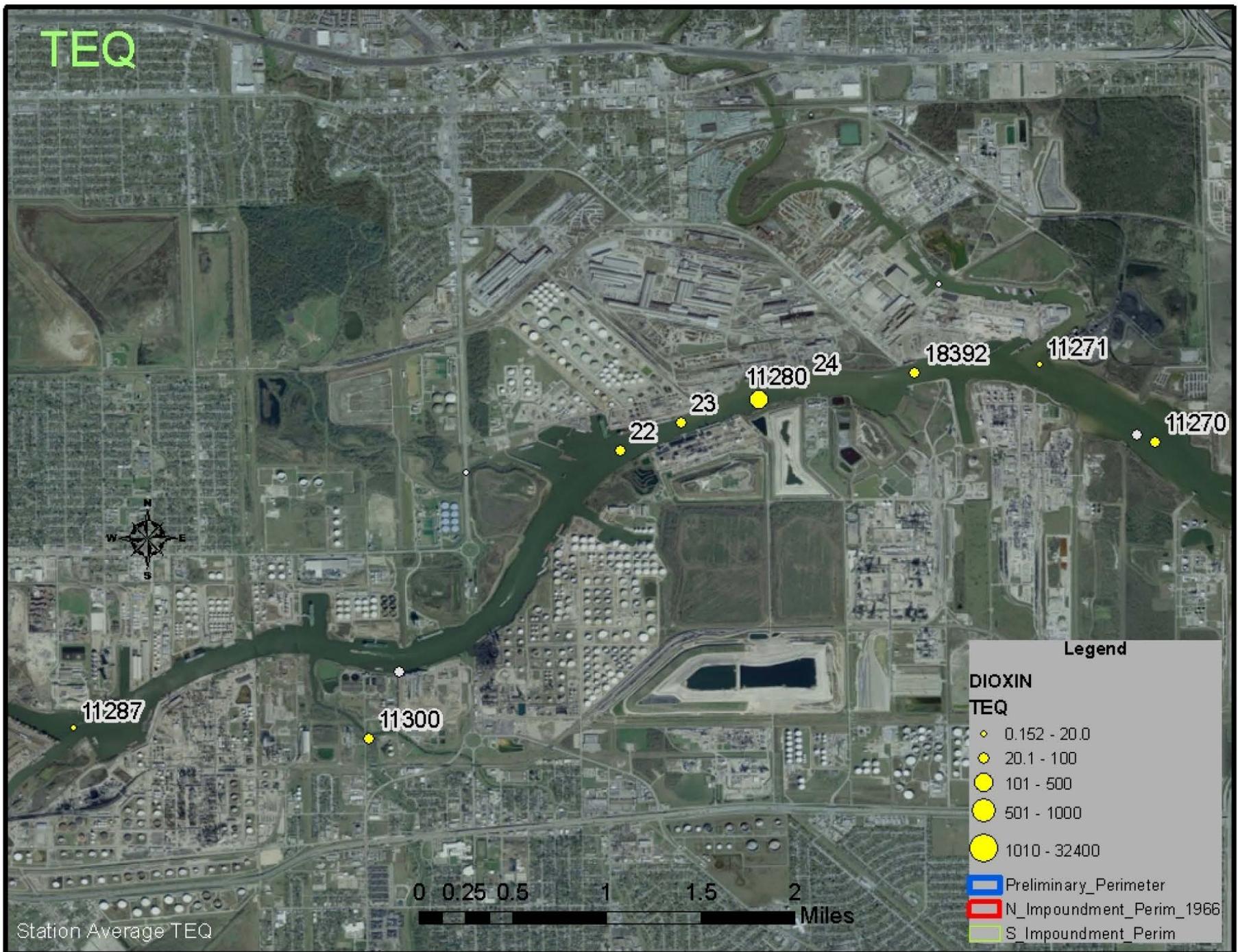
TEQ range = 22 to 159 ppt

HSC - Greens Bayou to Patrick Bayou

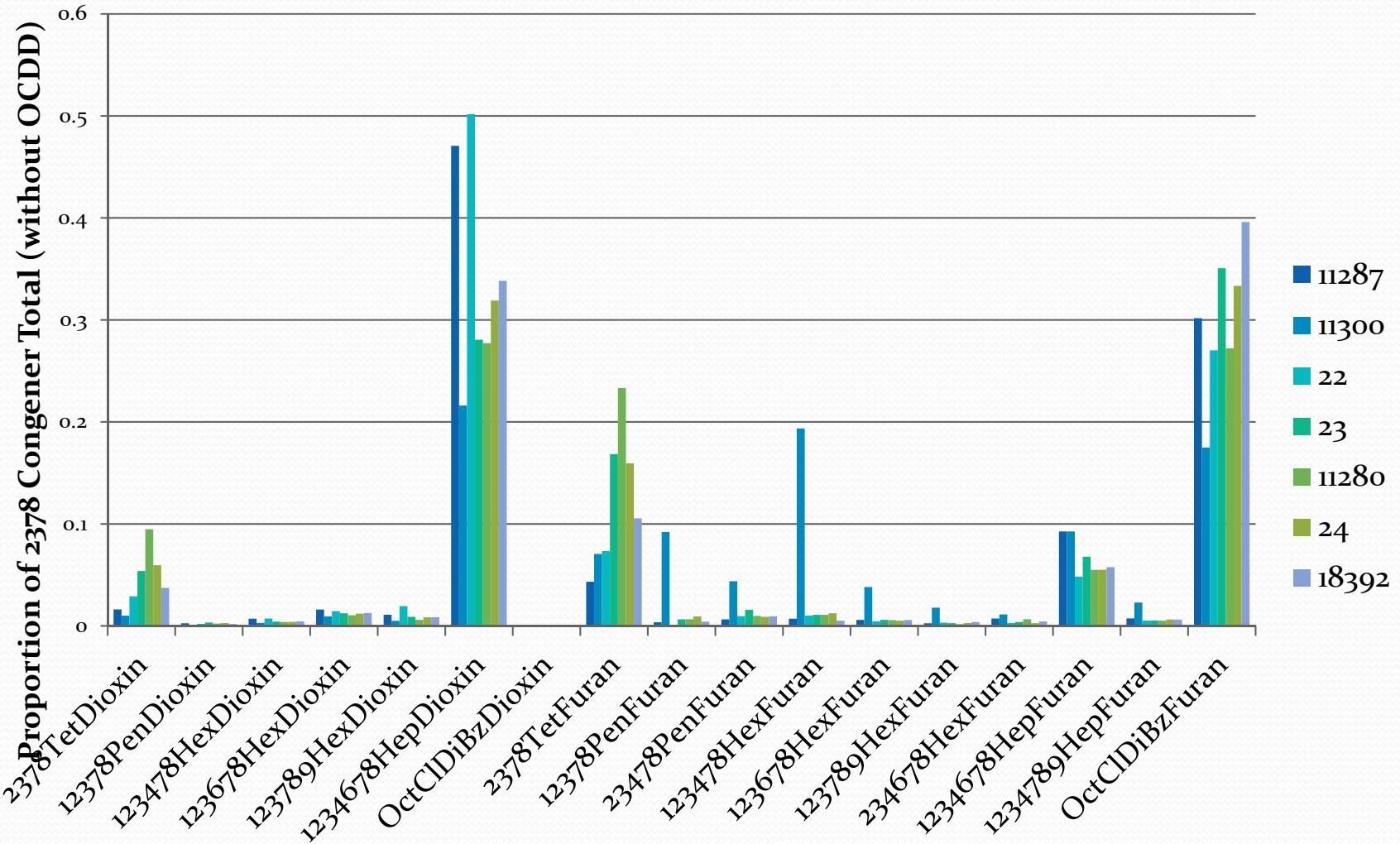


11270 TEQ = 74 ppt, 15979 TEQ = 71 ppt, Others < 44 ppt

TEQ



HSC - Sims Bayou to Greens Bayou



11287 TEQ = 14 ppt, 11300 TEQ = 84 ppt 11280 TEQ = 194 ppt, others < 63 ppt

Observations – HSC/Buffalo Bayou

Patrick Bayou to Tucker Bayou: fingerprint dominated by OCDF

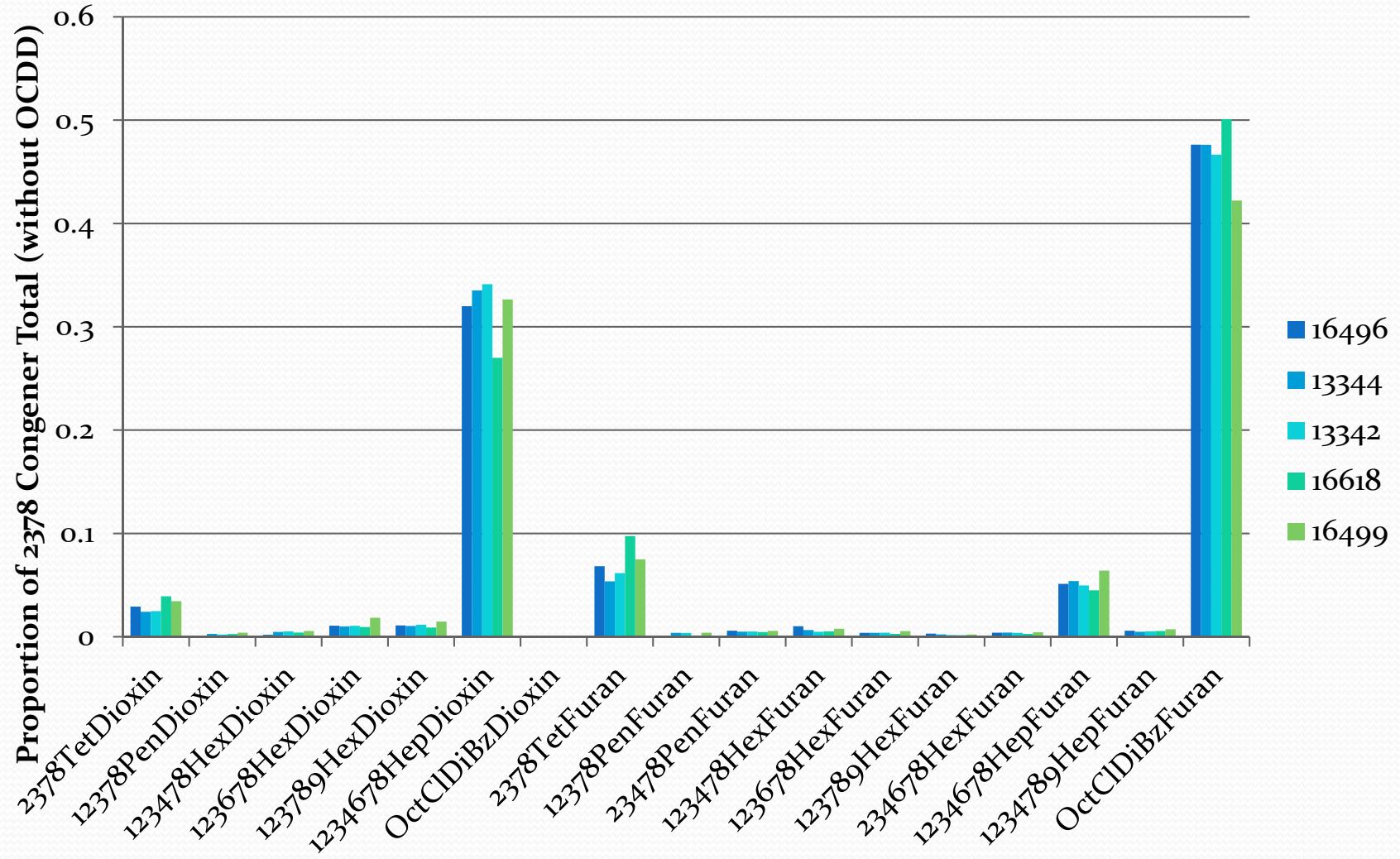
- some HpCDDs, TCDFs, and HpCDFs
- Greens Bayou to Patrick Bayou: fingerprint dominated by OCDF
 - Some HpCDDs, more TCDFs, and HpCDFs
- Sims Bayou to Greens Bayou: fingerprint dominated by OCDF
 - some HpCDDs, TCDFs, and HpCDFs
 - Small amounts of numerous other congeners

HSC Side Bays

- All have similar fingerprints
- Burnett Bay
 - 16496, TEQ = 34 ppt
 - 13344, TEQ = 29 ppt
- Scott Bay
 - 13342, TEQ = 29 ppt
 - 16618, TEQ = 24 ppt
- San Jacinto Bay
 - 16499, TEQ = 21.6 ppt



HSC Side Bay Congener Fingerprint

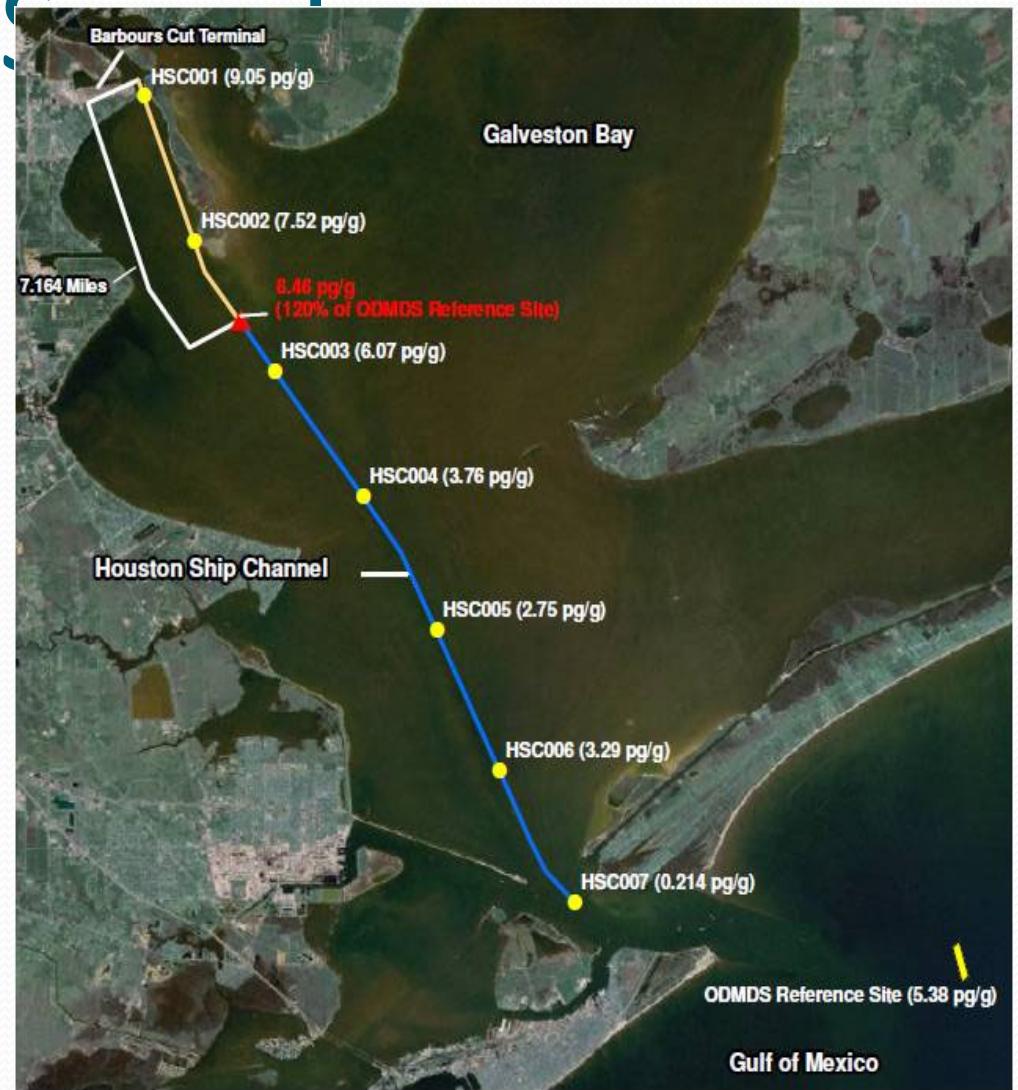


Observations – HSC Side Bays

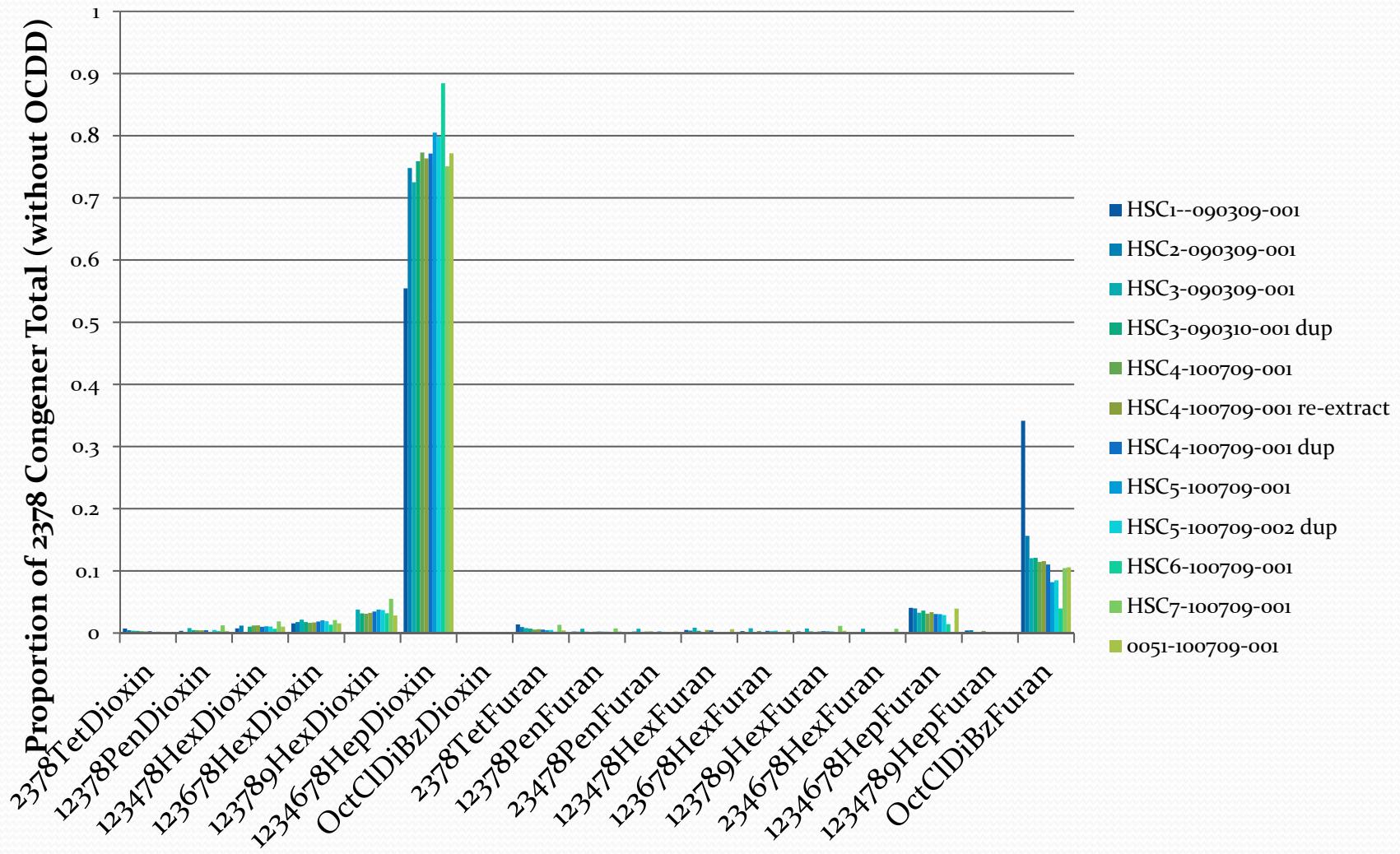
- All three side bays have very similar fingerprints
 - All three are dominated by OCDF; followed by HpCDDs, TCDFs, HpCDFs and TCDDs.
 - Each also has small amounts of other congeners
 - It is worth noting that this fingerprint appears similar to upstream HSC (OCDF, HpCDDs, HpCDFs) and San Jacinto (TCDDs & TCDFs) though the upstream HSC signal is more prominent

Galveston Bay

- TEQs range from 6.4 ppt to less than 1 ppt
- Fingerprint similar to Upstream SJR background fingerprint
- TEQs on the picture (right) were calculated using WHO 2005 TEFs



Galveston Bay Samples

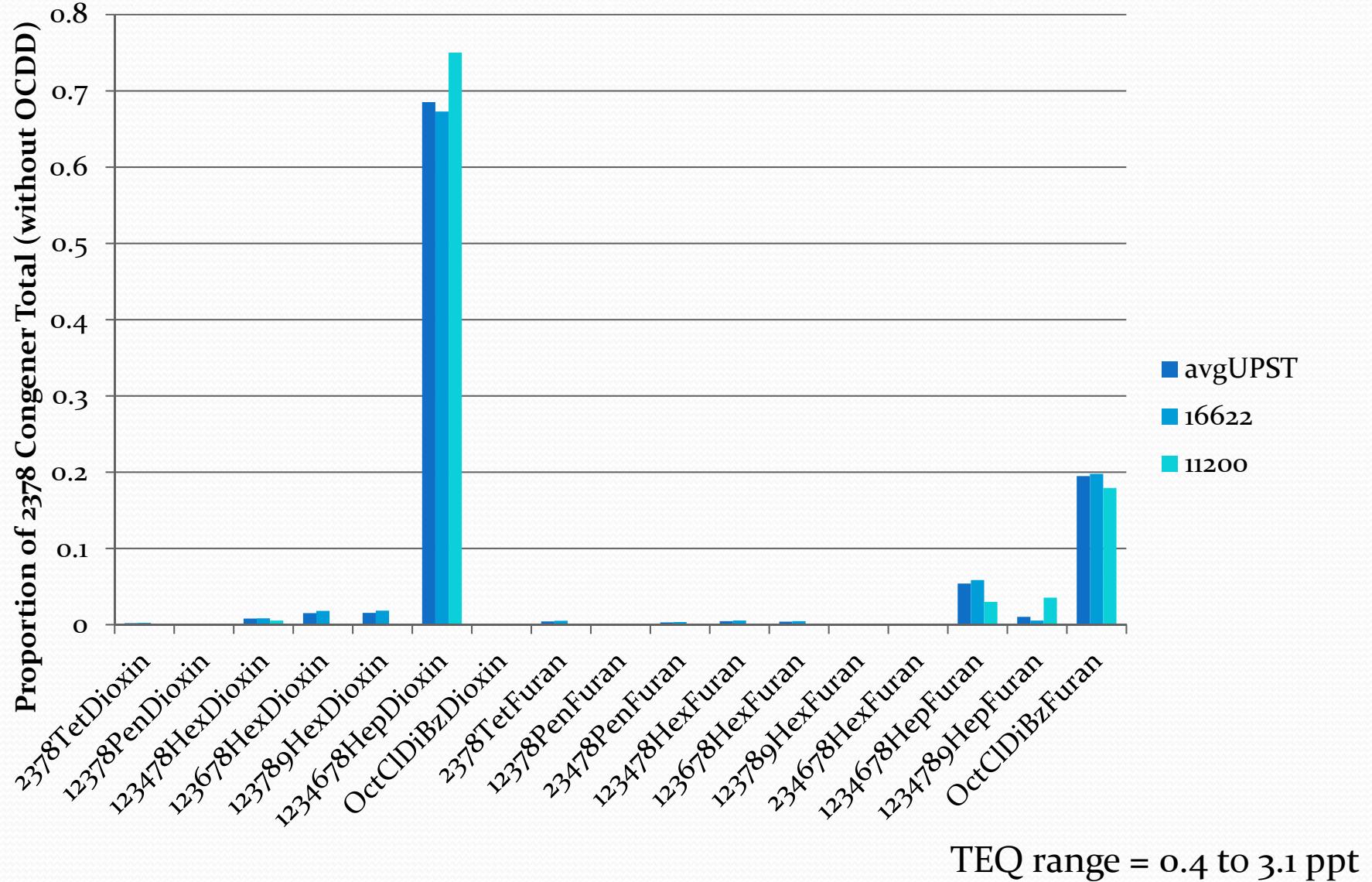


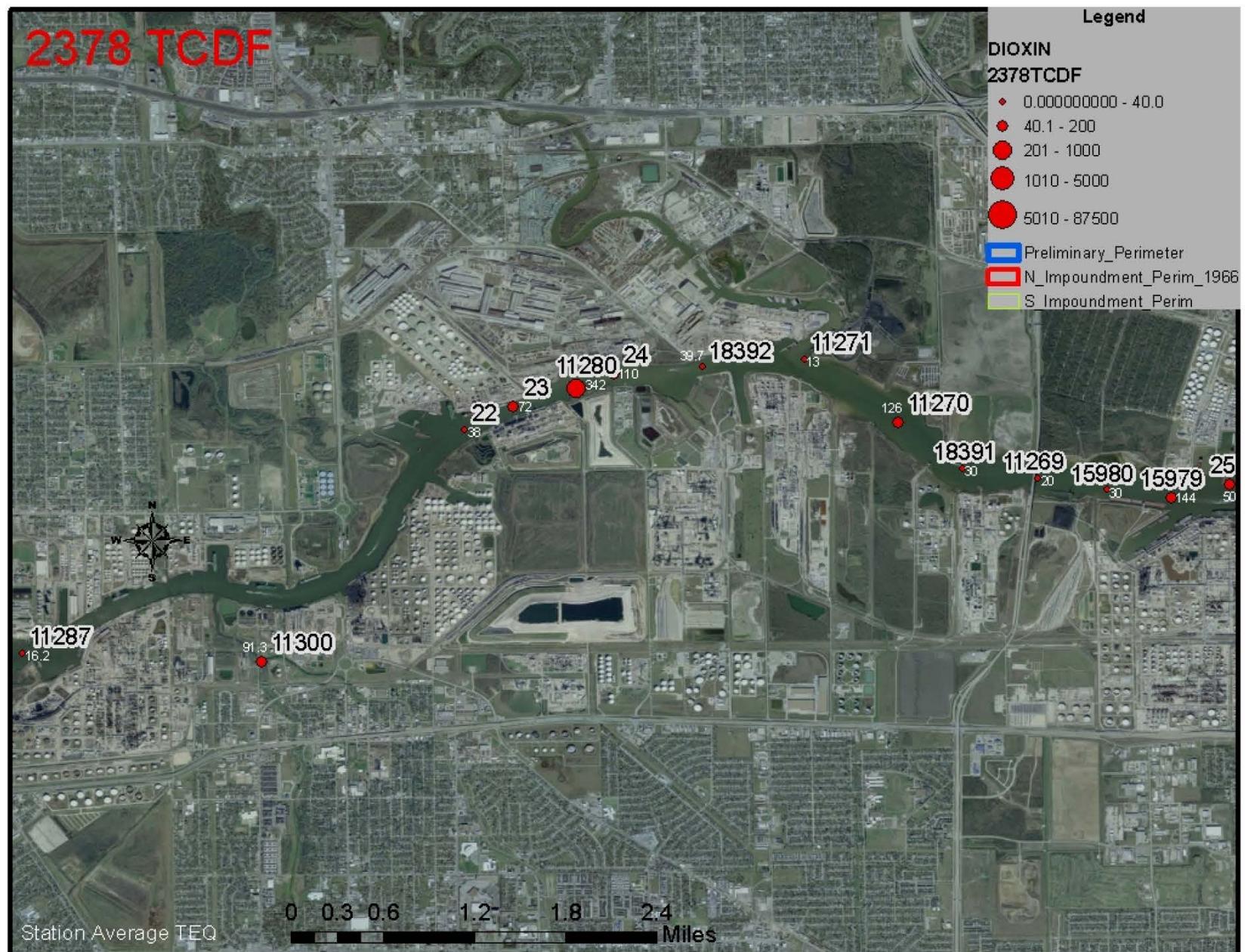
TEQ range from 0.2 to 6.4 ppt

Observations – HSC/Galveston Bay

- Fingerprint for all stations dominated by HpCDDs; followed by OCDF, HpCDDs and HpCDFs
 - Small amounts of most other congeners
- HSC₁ exhibited highest TEQ
- Decreasing TEQ with distance downstream
- Looks much like the upstream SJR samples once you get into Galveston Bay

Upstream SJR Congener Fingerprint





OCDF



